

A STATISTICAL SURVEY OF OHIO WINTER BIRD LIFE.

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Ornithology was prominent among the biological sciences to first receive any great attention in Ohio. This early developed interest has continued down to the present day and several hundred articles have been published relating to various phases of Ohio bird life. One subject which has been almost entirely neglected until recently, is that which concerns the frequency of occurrence and the relative abundance of Ohio winter birds.

Although ornithologists in all sections of the country have co-operated for 32 years in an annual winter bird census sponsored by Bird Lore Magazine, no attempt has yet been made to assemble the large mass of Ohio data which has accumulated and to apply it to the solution of problems which concern the numbers and distribution of our winter birds.

In the past few years the writers have carefully compiled all the data from Ohio censuses and in the following pages have attempted to present this information in a usable form along with certain interpretations. Little attempt has been made to evaluate the data. They are presented merely for whatever value they may have. Much additional information has also been prepared and placed on file, including for each species the number of individuals observed each year, the average number per census and graphs showing any actual or apparent yearly fluctuations in numbers as shown by the census counts. It is planned to continue this compilation from year to year. These data are available for use by anyone interested in further research on the subject.

All census enumerators have followed a standard plan recommended by Bird Lore since 1900. The usual procedure

is to begin the census field work as early as possible after sunrise, carefully covering an area not to exceed 15 miles in diameter. The observer or party of observers (sometimes several parties working separately), enumerates all birds seen on the trip and tabulates the totals for each species, total number of species and total number of individuals seen. Census co-operators usually spend the full day (seldom less than one-half day) in the field and cover all available area types to get



FIG. 1. Map of Ohio showing census localities.

as nearly as possible a representative picture of the bird life of their section. Records of the temperature, general weather conditions, miles traveled, and various miscellaneous data are sent to Bird Lore. Censuses are taken on any day from December 21 to December 27, and the results are published in the January-February issue of the magazine each year.

Various obvious limitations occur in the use of this compiled information. The data must be properly interpreted and corrected for a number of factors as will be pointed out later in this article. The census observers are, for the most part,

well trained and competent to make counts and correct identifications. The quality of the censuses has steadily increased from year to year as the work became of increasing interest and the co-operators developed a technique for an efficient and more thorough enumeration. The number of species observed per census has also increased. This is believed to be largely due to the increasing interest, greater effort expended,

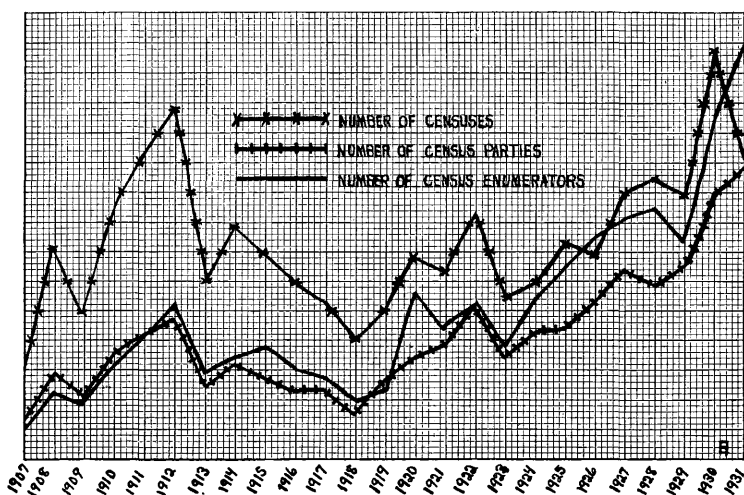


FIG. 2. Graph showing the relative variation from year to year in the number of censuses taken, the number of census parties (sometimes from 2 to 6 census parties combine their records in one census report), and the number of census enumerators. (For actual values of each, see text.) Any graphs made from census data to show the fluctuation in numbers from year to year of a species, should be superimposed upon this graph to aid in proper evaluation of the statistics. This will assist in determining whether certain apparent fluctuations indicate actual changes in numbers.

and the fact that many censuses formerly taken by one or two observers are now secured through the efforts of a group of 5 to 20 enumerators, frequently working in several parties and covering much larger areas than formerly. Exactly half of the censuses by more than two observers have been taken from 1925 to 1931, and half of those taking censuses have participated since 1924.

A summary of the censuses taken to date is shown in Table I, on the following page.

TABLE I.

Year	Number of Censuses Taken	Number of Census Parties	Number of Census Cooperators	Total Species in Whole State	Average Number of Species per Census	Average Number of Species per Census—Period Av'ge
1900.....	1	1	1	17	14	1900-1906 15.6
1901.....	2	2	2	17	10.5	
1902.....	4	4	4	22	13	
1903.....	3	3	5	26	19.6	
1904.....	3	3	5	27	16.6	
1905.....	2	2	3	24	16	
1906.....	2	2	3	27	19.5	
1907.....	5	5	8	29	12.2	1907-1911 12.8
1908.....	15	15	18	47	13.8	
1909.....	10	10	15	36	13.6	
1910.....	17	18	24	40	11.4	
1911.....	21	21	29	41	13.1	
1912.....	24	24	38	57	15.9	1912-1916 16.1
1913.....	12	12	20	48	16.8	
1914.....	16	16	25	47	17.3	
1915.....	14	14	28	51	14.5	
1916.....	12	12	22	50	16.0	
1917.....	11	12	19	50	16.3	1917-1921 16.8
1918.....	8	8	14	44	14.3	
1919.....	10	13	18	48	16.4	
1920.....	14	17	41	57	17.7	
1921.....	13	19	32	60	19.5	
1922.....	17	26	39	61	23.6	1922-1926 24.2
1923.....	11	16	27	69	23.1	
1924.....	12	21	38	70	25.6	
1925.....	15	22	46	73	25.2	
1926.....	14	26	54	74	23.8	
1927.....	18	32	58	84	26.3	1927-1931 25.7
1928.....	19	29	57	72	24.8	
1929.....	18	31	52	71	25.6	
1930.....	27	45	81	81	21.4	
1931.....	21	49	98	108	30.8	
Total.....	392	529	934	18.8	

Species per census 1900-1931 = 18.8. Species per census 1922-1931 = 25.0.

199 censuses taken by single	observers averaged in number of species.....	18.0
108 censuses taken by two	observers averaged in number of species.....	18.7
30 censuses taken by three	observers averaged in number of species.....	18.7
18 censuses taken by four	observers averaged in number of species.....	20.8
10 censuses taken by five	observers averaged in number of species.....	25.0
6 censuses taken by six	observers averaged in number of species.....	29.0
3 censuses taken by seven	observers averaged in number of species.....	37.3
2 censuses taken by eight	observers averaged in number of species.....	26.0
4 censuses taken by nine	observers averaged in number of species.....	32.0
2 censuses taken by ten	observers averaged in number of species.....	43.0
3 censuses taken by eleven	observers averaged in number of species.....	40.3
3 censuses taken by twelve	observers averaged in number of species.....	46.3

In addition, single censuses by 13, 15, 16 and 18 observers secured 47, 34, 40 and 50 species respectively.

The following species of Ohio winter birds have been reported in the Christmas Censuses published in Bird Lore from 1901 to 1932, including a total of 392 censuses taken during the 32 years from 1900 to 1931, inclusive. A total of 934 co-operators (about 500 different persons), have taken part in these censuses, from 79 localities in 49 Ohio counties. In all, a total of 133 species and 222,825 individuals have been recorded. Nomenclature and arrangement is that of the American Ornithologists' Union Check List (1931) 4th Edition.

1. Common Loon. *Gavia immer immer* Brunnich.
2. Holboell's Grebe. *Colymbus grisenga holboelli* Reinhardt.
3. Horned Grebe. *Colymbus auritus* Linnaeus.
4. Pied-billed Grebe. *Podilymbus podiceps podiceps* Linnaeus.
5. Double-crested Cormorant. *Phalacrocorax auritus auritus* Lesson.
6. Great Blue Heron. *Ardea herodias herodias* Linnaeus.
7. Black-crowned Night Heron. *Nycticorax nycticorax hoactli* Gmelin.
8. American Bittern. *Bolaurus lentiginosus* Montague.
9. Common Canada Goose. *Branta canadensis canadensis* Linnaeus.
10. Lesser Snow Goose. *Chen hyperborea hyperborea* Pallas.
11. Common Mallard. *Anas platyrhynchos platyrhynchos* Linnaeus.
12. Common Black Duck. *Anas rubripes rubripes* Brewster. (Including the Red-legged Black Duck, *Anas rubripes rubripes* Brewster.)
13. Gadwall. *Chaulelasmus streperus* Linnaeus.
14. Baldpate. *Mareca americana* Gmelin.
15. American Pintail. *Dafila acuta tsitzihoa* Vieillot.
16. Green-winged Teal. *Nettion carolinense* Gmelin.
17. Shoveller. *Spatula clypeata* Linnaeus.
18. Redhead. *Nyroca americana* Eyton.
19. Ring-necked Duck. *Nyroca collaris* Donovan.
20. Canvasback. *Nyroca valisineria* Wilson.
21. Lesser Scaup. *Nyroca affinis* Eyton.
22. American Goldeneye Duck. *Glaucionetta clangula americana* Bonaparte.
23. Bufflehead. *Charitonetta albeola* Linnaeus.
24. Oldsquaw Duck. *Clangula hyemalis* Linnaeus.
25. White-winged Scoter. *Melanitta deglandi* Bonaparte.
26. Ruddy Duck. *Erismatura jamaicensis rubida* Wilson.
27. Hooded Merganser. *Lophodytes cucullatus* Linnaeus.
28. American Merganser. *Mergus merganser americanus* Cassin.
29. Red-breasted Merhanser. *Mergus serrator* Linnaeus.
30. Turkey Vulture. *Cathartes aura septentrionalis* Wied.
31. Black Vulture. *Coragyps atratus atratus* Meyer.
32. Eastern Goshawk. *Asiur atricapillus atricapillus* Wilson.
33. Sharp-shinned Hawk. *Accipiter velox* Wilson.
34. Cooper's Hawk. *Accipiter cooperi* Bonaparte.
35. Eastern Red-tailed Hawk. *Buteo borealis* Gmelin.
36. Northern Red-shouldered Hawk. *Buteo lineatus lineatus* Gmelin.
37. American Rough-legged Hawk. *Buteo lagopus s. johannis* Gmelin.
38. Golden Eagle. *Aquila chrysaetos canadensis* Linnaeus.
39. Northern Bald Eagle. *Haliaeetus leucocephalus alascanus* Townsend.
40. Marsh Hawk. *Circus hudsonius* Linnaeus.
41. Duck Hawk. *Falco peregrinus anatum* Bonaparte.
42. Eastern Pigeon Hawk. *Falco columbarius columbarius* Linnaeus.
43. Eastern Sparrow Hawk. *Falco sparverius sparverius* Linnaeus.
44. Ruffed Grouse. *Bonasa umbellus umbellus* Linnaeus.
45. Hungarian or European Partridge. *Perdix perdix perdix* Linnaeus.
46. Eastern Bobwhite. *Colinus virginianus virginianus* Linnaeus.
47. Ring-necked Pheasant. *Phasianus colchicus torquatus* Gmelin.
48. American Coot. *Fulica americana americana* Gmelin.

49. Killdeer. *Oxyechus vociferus vociferus* Linnaeus.
50. American Woodcock. *Philohela minor* Gmelin.
51. Wilson's Snipe. *Capella delicata* Ord.
52. Herring Gull. *Larus argentatus smithsonianus* Coues.
53. Ring-billed Gull. *Larus delawarensis* Ord.
54. Franklin's Gull. *Larus pipixcan* Wagler.
55. Bonaparte's Gull. *Larus philadelphia* Ord.
56. Eastern Mourning Dove. *Zenaidura macroura carolinensis* Linnaeus.
57. Barn Owl. *Tyto alba pratincola* Bonaparte.
58. Eastern Screech Owl. *Otus asio naevius* Gmelin.
59. Great Horned Owl. *Bubo virginianus virginianus* Gmelin.
60. Snowy Owl. *Nyctea nyctea* Linnaeus.
61. Barred Owl. *Strix varia varia* Barton.
62. Long-eared Owl. *Asio wilsonianus* Lesson.
63. Short-eared Owl. *Asio flammeus flammeus* Pontoppidan.
64. Saw-whet Owl. *Cryptoglaux acadica acadica* Gmelin.
65. Eastern Belted Kingfisher. *Megaceryle alcyon alcyon* Linnaeus.
66. Northern Flicker. *Colaptes auratus luteus* Bangs.
67. Northern Pileated Woodpecker. *Coephaloeus pileatus abieticola* Bangs.
68. Red-bellied Woodpecker. *Centurus carolinus* Linnaeus.
69. Red-headed Woodpecker. *Melanerpes erythrocephalus* Linnaeus.
70. Yellow-bellied Sapsucker. *Sphyrapicus varius varius* Linnaeus.
71. Eastern Hairy Woodpecker. *Dryobates villosus villosus* Linnaeus.
72. Northern Downy Woodpecker. *Dryobates pubescens medianus* Swainson.
73. Eastern Phoebe. *Sayornis phoebe* Latham.
74. Northern Horned Lark. *Otocorus alpestris alpestris* Linnaeus.
75. Prairie Horned Lark. *Otocorus alpestris praticola* Henshaw.
76. Northern Blue Jay. *Cyanocitta cristata cristata* Linnaeus.
77. Eastern Crow. *Corvus brachyrhynchos brachyrhynchos* Brehm.
78. Black-capped Chickadee. *Penthestes atricapillus atricapillus* Linnaeus.
79. Carolina Chickadee. *Penthestes carolinensis carolinensis* Audubon.
80. Tufted Titmouse. *Baeolophus bicolor* Linnaeus.
81. White-breasted Nuthatch. *Sitta carolinensis carolinensis* Latham.
82. Red-breasted Nuthatch. *Sitta canadensis* Linnaeus.
83. Brown Creeper. *Certhia familiaris americana* Bonaparte.
84. Eastern Winter Wren. *Nannus hiemalis hiemalis* Vieillot.
85. Bewick's Wren. *Thryomanes bewicki bewicki* Audubon.
86. Carolina Wren. *Thryothorus ludovicianus ludovicianus* Latham.
87. Prairie (Long-billed) Marsh Wren. *Telmatodytes palustris dissaepius* Bangs.
88. Eastern Mockingbird. *Mimus polyglottos polyglottos* Linnaeus.
89. Brown Thrasher. *Toxostoma rufum* Linnaeus.
90. Eastern Robin. *Turdus migratorius migratorius* Linnaeus.
91. Wood Thrush. *Hylocichla mustelina* Gmelin.
92. Eastern Hermit Thrush. *Hylocichla guttata faxoni* Bangs & Penard.
93. Eastern Bluebird. *Sialia sialis sialis* Linnaeus.
94. Eastern Golden-crowned Kinglet. *Regulus satrapa satrapa* Lichtenstein.
95. Eastern Ruby-crowned Kinglet. *Corthylio calendula calendula* Linnaeus.
96. American Pipit. *Anthus spinoletta rubescens* Tunstall.
97. Bohemian Waxwing. *Bombycilla garrula pallidiceps* Reichnow.
98. Cedar Waxwing. *Bombycilla cedrorum* Vieillot.
99. Northern Shrike. *Lanius borealis borealis* Vieillot.
100. Migrant Shrike. *Lanius ludovicianus migrans* Palmer.
101. Starling. *Sturnus vulgaris vulgaris* Linnaeus.
102. Orange-crowned Warbler. *Vermivora celata* Say.
103. Myrtle Warbler. *Dendroica coronata* Linnaeus.
104. Western Palm Warbler. *Dendroica palmarum palmarum* Gmelin.
105. Eastern Meadowlark. *Sturnella magna magna* Linnaeus.
106. Eastern Red-wing. *Agelaius phoeniceus phoeniceus* Linnaeus.
107. Rusty Blackbird. *Euphagus carolinus* Muller.
108. Bronzed Grackle. *Quiscalus quiscula aeneus* Ridgeway.
109. Eastern Cowbird. *Molothrus ater ater* Boddaert.
110. Eastern Cardinal. *Richmondia cardinalis cardinalis* Linnaeus.
111. Indigo Bunting. *Passerina cyanea* Linnaeus.

112. Eastern Evening Grosbeak. *Hesperiphona vespertina vespertina* Cooper.
113. Eastern Purple Finch. *Carpodacus purpureus purpureus* Gmelin.
114. Canadian Pine Grosbeak. *Pinicola enucleator leucura* Muller.
115. Common Redpoll. *Acanthis linaria linaria* Linnaeus.
116. Northern Pine Siskin. *Spinus pinus pinus* Wilson.
117. Eastern Goldfinch. *Spinus tristis tristis* Linnaeus.
118. Red Crossbill. *Loxia curvirostra pusilla* Gloger.
119. White-winged Crossbill. *Loxia leucoptera* Gmelin.
120. Red-eye Twohee. *Pipilio erythrophthalmus erythrophthalmus* Linnaeus.
121. Eastern Vesper Sparrow. *Pooectes gramineus gramineus* Gmelin.
122. Slate-colored Junco. *Junco hyemalis* Linnaeus.
123. Eastern Tree Sparrow. *Spizella arborea arborea* Wilson.
124. Eastern Chipping Sparrow. *Spizella passerina passerina* Beckstein.
125. Eastern Field Sparrow. *Spizella pusilla pusilla* Wilson.
126. White-crowned Sparrow. *Zonotrichia leucophrys leucophrys* Forster.
127. White-throated Sparrow. *Zonotrichia albicollis* Gmelin.
128. Eastern Fox Sparrow. *Passerella iliaca iliaca* Merrem.
129. Swamp Sparrow. *Melospiza georgiana* Latham.
130. Mississippi Song Sparrow. *Melospiza melodia beata* Bangs.
131. Lapland Longspur. *Calcarius lapponicus lapponicus* Linnaeus.
132. Eastern Snow Bunting. *Plectrophenax nivalis nivalis* Linnaeus.

The following additional species have been reported one or more times by various census enumerators but have been omitted from the above list because there is some question as to their proper identification and occurrence during the Christmas season: Green Heron (*Butorides virescens virescens* Linn.), Broad-winged Hawk (*Buteo platypterus platypterus* Vieillot), Greater Scaup (*Nyroca marila* Linn.), and Pomarine Jaeger (*Stercorarius pomarinus* Temm.). The Chickadees recorded in the censuses were frequently incorrectly listed as to species, or merely listed without determination of species. Records of Chickadees in the enumeration have been divided between the two species occurring in Ohio according to the present known local range of each in winter. Birds listed merely as Horned Larks have been referred to the Northern Horned Lark, though a number of these were probably Prairie Horned Larks and perhaps a few, Hoyt's Horned Larks. A number of unidentified ducks, hawks, owls and other birds have been disregarded in the enumeration.

The total number of accepted species listed on the census reports totals 133. Twenty-nine additional species are known to have occurred in Ohio during the winter season, but have never been observed during a Christmas census, making a total of 162 species, (see Annotated Check-list of Ohio Winter Birds, L. E. Hicks, 1932). These are as follows:

- Gannet. *Moris bassana* Linnaeus.
- Blue Goose. *Chen caerulescens* Linnaeus.
- Red-legged Black Duck. *Anas rubripes rubripes* Brewster.
- Greater Scaup. *Nyroca marila* Linnaeus.

Barrow's Golden-eye. *Glaucionetta islandica* Gmelin.
 American Eider. *Somateria mollissima dresseri* Sharpe.
 King Eider. *Somateria spectabilis* Linnaeus.
 Surf Scoter. *Melanitta perspicillata* Linnaeus.
 Broad-winged Hawk. *Buteo platypterus platypterus* Vieillot.
 Osprey. *Pandion haliaetus carolinensis* Gmelin.
 Black Gyrfalcon. *Falco rusticolus obsoletus* Gmelin.
 Prairie Chicken. *Tympanuchus cupido americanus* Reichenbach.
 Virginia Rail. *Rallus limicola limicola* Vieillot.
 Florida Gallinule. *Gallinula chloropus cachinnans* Bangs.
 Iceland Gull. *Larus leucopterus* Vieillot.
 Great Black-backed Gull. *Larus marinus* Linnaeus.
 Atlantic Kittewake. *Rissa tridactyla tridactyla* Linnaeus.
 Brunnich's Murre. *Uria lomvia lomvia* Linnaeus.
 American Hawk Owl. *Surnia ulula caparoch* Muller.
 Great Gray Owl. *Scotiaptex nebulosa nebulosa* Forster.
 Arctic Three-toed Woodpecker. *Picoides arcticus* Swainson.
 Hoyt's Horned Lark. *Otocoris alpestris hoyti* Bishop.
 Pine Warbler. *Dendroica pinus pinus* Wilson.
 Northern Yellowthroat. *Geothlypis trichas brachidactyla* Swainson.
 English Sparrow. *Passer domesticus domesticus* Linnaeus. (Not enumerated.)
 Baltimore Oriole. *Icterus galbula* Linnaeus.
 Savannah Sparrow. *Passerculus sandwichensis savanna* Wilson.
 Grasshopper Sparrow. *Ammodramus savannarum australis* Maynard.
 Smith's Longspur. *Calcarius pictus* Swainson.

The results of the following tabulated data, if properly interpreted, will contribute answers to many important questions concerning Ohio winter bird life, especially those relating to frequency of occurrence and the relative abundance of species present. Individuals actually recorded on any field trip never give an exactly accurate picture of the total bird population present. Corrections must be made for a number of obvious factors. Human tendencies and weaknesses as well as the general habits of the species must be taken into consideration. Certain species will be recorded in numbers not indicative of their true abundance because of:

- (1) having loud, clear, frequently uttered notes or songs, making it possible to identify and record the species from a considerable distance, resulting in an actual survey of a larger area for some species than for others.
- (2) excessive activity, curiosity and tameness, large size, and conspicuous plumage.
- (3) having habits which make the species observable in readily accessible places and against backgrounds which make the bird conspicuous. Example, ground birds vs. arboreal species.
- (4) habits of concentration about water, cover, special habitats or where certain foods abound, making it possible to record the species in excess of its true numbers.
- (5) activity and presence in accessible areas or locations during hours of the census. For example, according to compiled data, 725

Sparrow Hawks were recorded on 205 or 52% of a total of 392 censuses taken, while only 157 Screech Owls were recorded on 98 or 25% of the censuses and were not checked on the remaining 235. Because of its nocturnal and secretive habits, the latter species is never recorded in proportion to its true numbers and there is good reason to believe that the Screech Owl actually exceeds the Sparrow Hawk in numbers in most Ohio localities during winter.

- (6) various historical factors involved. Many species have been decidedly increasing or decreasing in numbers. The figures indicated do not show the present status but the average for a 32-year period. Since the census work began, one species, the Ring-necked Pheasant, has been widely introduced, now occurs in every county and is common to abundant in more than half of the state. Another game bird, the Hungarian Partridge, has been introduced generally and has become common or abundant in about 20 north-western counties, occurring locally in certain other sections.

The European Starling was first reported from Ohio in January, 1916, from West Lafayette, Coshocton County. The writers have observed the species every year since 1918, making a special study of its first appearances and its subsequent invasion of the state. Records of the species became frequent from 1920 to 1923, and the birds were abundant from 1924 to 1928, spreading westward and southwestward to every county. Starlings were first recorded on a Christmas census in 1920. One report in 1922 gave 14 birds; 2 in 1923, 61; 4 in 1924, 56; 5 in 1925, 177; 12 in 1927, 455; 12 in 1928, 1,218; 13 in 1929, 2,557; 21 in 1930, 2,174; and 27 censuses in 1931 reported 8,570 birds.

Although, of course, not so indicated in the table because of its short occurrence in the state, the Starling is now one of the five commonest, and probably the most common bird in winter, outnumbering on reports of the last five years, all other species except the Crow.

- (7) flocking tendencies on the part of certain species. This is a particularly important factor. Flocking and gregarious species always give the impression of being much more abundant than they really are and will be recorded in greater than their actual relative numbers on census lists because of their conspicuousness, ready identification and concentration. This occurs in spite of the fact that most observers tend to greatly underestimate the size of bird flocks, where actual counts cannot be taken.

Of the first ranking 25 species on the basis of individual numbers, 17 are flocking species. Of the first ranking 25 on the basis of number of censuses reporting the bird, only 10 are of the flocking type. In determining the actual status of a species and its true abundance, there is good evidence to show that not only the number of individuals recorded, but also the regularity of occurrence, should be taken into consideration. Where both of these indicators of abundance are used, the list of the first 25 includes 12 gregarious species.

In the table below, column No. 1 ranks the 132 birds reported on censuses by taking into equal consideration the number of individuals reported and the number of times occurring on censuses. Column 2 gives first the number of censuses on which each species has been listed out of a total of 392 taken from 1900 to 1931, and secondly, the number of years in which each species was recorded. Column 3 shows the total number of individuals of each species reported. Column 4 lists the percent of censuses reporting each species, or in other words, the percent of probability of seeing each species on an average winter hike during the Christmas season. This probability, of course, would not apply uniformly to all sections of the state. Column 5 indicates the percent of the total bird population which each species forms. For example, the table indicates that one-fourth of all Ohio winter birds are Crows, nearly one-fifth Tree Sparrows and that one bird of each 32 is a Cardinal. Column 6 ranks each species according to the number of individuals reported and No. 7, according to the number of times checked on census reports.

TABLE II.

Rank of Species Based on Both Numbers and Occurrences	Number Censuses and Num- ber of Years on which Reported	Total Number Individuals Seen	Percent of Censuses Report- ing	Percent of Total Bird Popula- tion	Ranking Accord- ing to Individ- uals	Ranking Accord- ing to Number Times Reported
1	2	3	4	5	6	7
1. Tree Sparrow.....	359—32	42,143	91.5	18.90	2	3
2. Cardinal.....	363—32	7,086	92.6	3.17	6	2
3. Song Sparrow.....	351—32	8,119	88.0	3.65	5	4
4. Crow.....	255—28	56,841	64.9	25.40	1	10
5. Slate-colored Junco....	322—31	15,236	82.1	6.83	4	7
6. Downy Woodpecker....	374—32	4,503	95.4	2.01	11	1
7. Tufted Titmouse.....	345—32	6,776	88.0	3.04	7	6
8. White-br. Nuthatch....	349—32	4,695	89.0	2.10	10	5
9. Bob-white.....	209—30	6,767	53.3	3.03	8	13
10. Blue Jay.....	300—32	2,777	76.5	1.24	17	9
11. Black-capped Chickadee.....	179—32	5,050	45.6	2.37	9	16
12. Starling.....	98—11	15,782	25.0	7.08	3	26
13. Car. Chickadee.....	159—30	4,114	40.5	1.84	12	18
14. Hairy Woodpecker.....	302—31	1,096	77.0	.49	26	8
15. Northern Flicker.....	210—31	1,260	53.5	.56	24	12
16. Mourning Dove.....	114—27	2,896	29.1	1.30	16	22
17. Brown Creeper.....	191—26	1,198	48.7	.54	25	15
18. Goldfinch.....	156—29	1,593	39.8	.71	21	19
19. Red-bel. Woodpecker..	211—31	945	53.8	.42	31	11
20. Robin.....	102—27	1,910	28.5	.85	20	23
21. Sparrow Hawk.....	205—30	725	52.3	.33	35	14
22. Carolina Wren.....	176—29	905	54.9	.40	32	17

TABLE II—(Continued)

Rank of Species Based on Both Numbers and Occurrences	Number Censuses and Number of Years on which Reported	Total Number Individuals Seen	Percent of Censuses Report- ing	Percent of Total Bird Popula- tion	Ranking Accord- ing to Individ- uals	Ranking Accord- ing to Number Times Reported
1	2	3	4	5	6	7
23. Gold-cr. Kinglet.....	143—27	1,024	36.4	.45	30	20
24. N. Horned Lark.....	57—17	2,950	14.5	1.33	15	38
25. Red-h. Woodpecker....	98—24	1,028	25.5	.46	29	24
26. Herring Gull.....	63—18	1,365	16.1	.61	23	35
27. Meadowlark.....	91—21	886	23.2	.39	33	27
28. Black Duck.....	40—14	2,139	10.2	.95	18	44
29. Mallard.....	42—15	1,369	10.7	.61	22	43
30. Lesser Scaup.....	23—10	3,038	5.8	1.36	14	54
31. Red-tailed Hawk.....	122—30	208	30.8	.09	48	21
32. Towhee.....	76—20	512	19.3	.22	38	31
33. Bluebird.....	75—24	563	19.2	.25	37	32
34. Bonaparte's Gull.....	21—11	3,622	5.3	1.60	13	58
35. Pr. Horned Lark.....	40—19	1,032	10.2	.46	28	46
36. Red-winged Blackbird..	37—14	1,081	9.4	.48	27	47
37. Winter Wren.....	85—21	280	21.6	.12	44	30
38. Marsh Hawk.....	88—16	218	22.4	.09	47	20
39. Screech Owl.....	98—21	157	25.0	.07	53	25
40. Kingfisher.....	90—20	162	22.9	.07	51	28
41. Bronzed Grackle.....	55—22	289	14.0	.13	43	39
42. Cowbird.....	27—14	739	6.80	.33	34	50
43. Am. Merganser.....	40—17	410	10.2	.18	40	45
44. R. N. Pheasant.....	61—18	190	15.8	.08	49	36
45. R. B. Nuthatch.....	51—26	252	13.0	.11	46	40
46. Snow Bunting.....	12—6	2,114	4.0	.94	19	68
47. Cedar Waxwing.....	28—14	319	7.1	.14	41	49
48. Swamp Sparrow.....	25—11	304	6.3	.13	42	51
49. Red-should. Hawk.....	73—24	111	18.6	.04	60	33
50. Cooper's Hawk.....	64—21	100	16.3	.04	62	34
51. Purple Finch.....	24—13	254	6.1	.11	45	52
52. Pine Siskin.....	15—10	619	3.8	.27	36	63
53. Barred Owl.....	60—26	73	15.3	.03	64	37
54. Ruffed Grouse.....	51—25	103	13.0	.04	61	41
55. Sharp-shin. Hawk.....	45—23	63	10.1	.02	67	42
56. Golden-eye.....	21—12	149	5.3	.06	54	57
57. Rusty Blackbird.....	15—9	147	3.8	.06	56	62
58. Gr't. Horned Owl.....	36—20	45	9.4	.01	71	48
59. Short-eared Owl.....	18—12	70	4.6	.03	66	59
60. Ring-billed Gull.....	9—6	175	2.3	.07	50	78
61. Rough-legged Hawk....	24—13	36	6.1	.01	76	53
62. Hooded Merganser.....	10—7	147	2.5	.06	55	76
63. Redpoll.....	10—7	123	2.5	.05	58	73
64. Killdeer.....	14—8	59	3.5	.02	68	65
65. Y. B. Sapsucker.....	21—16	27	5.3	.01	80	56
66. Mockingbird.....	23—12	25	5.8	.01	82	55
67. American Coot.....	7—4	160	1.8	.07	52	86
68. Barn Owl.....	17—9	28	4.3	.01	79	60
69. Pileated Woodpecker..	16—10	26	4.1	.01	81	61
70. Canada Goose.....	7—5	136	1.8	.06	57	87
71. Field Sparrow.....	11—9	41	2.8	.01	74	72
72. Myrtle Warbler.....	11—7	37	2.8	.01	75	71
73. W. T. Sparrow.....	9—8	53	2.3	.02	69	77
74. Pintail.....	12—6	33	3.1	.01	78	69

TABLE II—(Continued)

Rank of Species Based on Both Numbers and Occurrences	Number Censuses and Num- ber of Years on which Reported	Total Number Individuals Seen	Percent of Censuses Report- ing	Percent of Total Bird Popula- tion	Ranking Accord- ing to Individ- uals	Ranking Accord- ing to Number Times Reported
1	2	3	4	5	6	7
75. Hungarian Partridge...	7—6	87	1.8	.03	63	85
76. Turkey Vulture.....	12—10	26	3.1	.01	83	67
77. Bewick's Wren.....	15—12	21	3.8	.009	87	64
78. Ruddy Duck.....	5—3	122	1.2	.05	59	92
79. Bald Eagle.....	12—11	24	3.1	.01	84	70
80. Red Crossbill.....	6—4	72	1.5	.03	65	90
81. Goshawk.....	14—7	15	3.5	.006	91	66
82. Pied-billed Grebe.....	7—6	8	1.8	.003	78	80
83. American Pipit.....	1—1	500	0.2	.220	39	121
84. Canvasback.....	7—5	43	1.8	.01	73	88
85. Red-br. Merganser.....	5—3	50	1.2	.02	70	93
86. Horned Grebe.....	10—6	16	2.5	.007	90	75
87. Fox Sparrow.....	8—6	19	2.0	.008	88	79
88. Northern Shrike.....	10—7	13	2.5	.005	95	74
89. Ring-necked Duck.....	4—3	35	1.0	.015	77	95
90. Lapland Longspur.....	7—6	15	1.8	.006	92	81
91. Baldpate.....	7—3	24	1.8	.010	85	89
92. Bufflehead.....	7—5	13	1.8	.005	94	83
93. Hermit Thrush.....	7—5	7	1.8	.003	99	82
94. Shoveller.....	4—2	19	1.0	.008	89	94
95. Black Vulture.....	3—3	44	0.7	.018	72	105
96. Great Blue Heron.....	6—4	8	1.5	.003	97	91
97. Bohemian Waxwing.....	3—3	14	0.7	.006	93	104
98. Redhead Duck.....	3—2	7	0.7	.003	101	99
99. Long-eared Owl.....	4—4	5	1.0	.002	103	97
100. Green-winged Teal.....	2—1	21	0.5	.009	86	114
101. Common Loon.....	4—2	4	1.0	.002	106	96
102. Gadwall.....	3—2	4	0.7	.002	105	103
103. Palm Warbler.....	3—3	4	0.7	.002	107	101
104. Pigeon Hawk.....	3—3	3	0.7	.001	112	100
105. Migrant Shrike.....	3—3	3	0.7	.001	111	102
106. Wilson's Snipe.....	3—3	3	0.7	.001	115	98
107. Old-squaw.....	2—2	7	0.5	.003	100	113
108. White-w'g'd Crossbill..	1—1	11	0.2	.004	96	118
109. B. Cr. Night Heron....	3—2	3	0.7	.001	110	106
110. W. Cr. Sparrow.....	2—2	4	0.5	.002	109	118
111. Saw-whet Owl.....	2—2	3	0.5	.001	114	110
112. Ruby-cr. Kinglet.....	2—2	3	0.5	.001	113	111
113. Prairie Marsh Wren....	1—1	4	0.2	.002	108	120
114. Wood Thrush.....	2—2	2	0.5	.0009	122	107
115. Snowy Owl.....	2—1	2	0.5	.0009	120	109
116. Phoebe.....	2—2	2	0.5	.0009	118	112
117. D. C. Cormorant.....	2—2	2	0.5	.0009	116	115
118. Evening Grosbeak.....	1—1	5	0.2	.002	102	129
119. Woodcock.....	2—2	2	0.5	.0009	121	116
120. Holboell's Grebe.....	1—1	2	0.2	.0009	117	126
121. Lesser Snow Goose.....	1—1	2	0.2	.0009	119	124
122. American Bittern.....	1—1	4	0.2	.002	104	132
123. White-winged Scoter...	1—1	1	0.2	.0005	132	117
124. Vesper Sparrow.....	1—1	1	0.2	.0005	131	119
125. Orange-cr. Warbler....	1—1	1	0.2	.0005	129	123
126. Pine Grosbeak.....	1—1	1	0.2	.0005	130	122

TABLE II—(Continued)

Rank of Species Based on Both Numbers and Occurrences	Number Censuses and Num- ber of Years on which Reported	Total Number Individuals Seen	Percent of Censuses Report- ing	Percent of Total Bird Popula- tion	Ranking Accord- ing to Individ- uals	Ranking Accord- ing to Number Times Reported
1	2	3	4	5	6	7
127. Indigo Bunting.....	1— 1	1	0.2	.0005	128	125
128. Golden Eagle.....	1— 1	1	0.2	.0005	127	127
129. Franklin's Gull.....	1— 1	1	0.2	.0005	126	128
130. Brown Thrasher.....	1— 1	1	0.2	.0005	123	132
131. Duck Hawk.....	1— 1	1	0.2	.0005	124	131
132. Chipping Sparrow.....	1— 1	1	0.2	.0005	124	130

SUMMARY—THIRTY-TWO YEARS, 1900–1931.

Total number of individuals seen.....	222,825
Total number of species.....	133
Total number of censuses taken.....	392
Total number of census co-operators.....	934
Average number species seen on each census, 1900–1931.....	18.8
Average number species seen on each census, 1922–1931.....	25.0
Average number individuals seen on each census (32 years)....	569
Number of counties (out of 88) in which censuses were taken...	49
Number of localities in which censuses were taken.....	79

The following comparisons should be of interest. The first ranking 25 species are given as follows:

RANK BASED ON NUMBER OF INDIVIDUALS	RANK BASED ON NUMBER OF TIMES REPORTED	RANK BASED ON BOTH THE NUMBERS OF INDIVIDUALS AND TIMES REPORTED
<ol style="list-style-type: none"> 1. Crow 2. Tree Sparrow 3. Starling 4. Junco 5. Song Sparrow 6. Cardinal 7. Tufted Titmouse 8. Bob-white 9. B. Cap. Chickadee 10. W. B. Nuthatch 11. Downy Woodpecker 12. Car. Chickadee 13. Bonaparte's Gull 14. Lesser Scaup 15. N. Horned Lark 16. Mourning Dove 17. Blue Jay 18. Black Duck 19. Snow Bunting 20. Robin 21. Goldfinch 22. Mallard 23. Herring Gull 24. Northern Flicker 25. Brown Creeper 	<ol style="list-style-type: none"> 1. Downy Woodpecker 2. Cardinal 3. Tree Sparrow 4. Song Sparrow 5. W. B. Nuthatch 6. Tufted Titmouse 7. Junco 8. Hairy Woodpecker 9. Blue Jay 10. Crow 11. Red-bel. Woodpecker 12. Northern Flicker 13. Bob-white 14. Sparrow Hawk 15. Brown Creeper 16. B. Cap. Chickadee 17. Carolina Wren 18. Car. Chickadee 19. Goldfinch 20. G. C. Kinglet 21. Red-tailed Hawk 22. Mourning Dove 23. Robin 24. Red-headed Woodpecker 25. Screech Owl 	<ol style="list-style-type: none"> 1. Tree Sparrow 2. Cardinal 3. Song Sparrow 4. Crow 5. Junco 6. Downy Woodpecker 7. Tufted Titmouse 8. W. B. Nuthatch 9. Bob-white 10. Blue Jay 11. B. Cap. Chickadee 12. Starling 13. Car. Chickadee 14. Hairy Woodpecker 15. Northern Flicker 16. Mourning Dove 17. Brown Creeper 18. Goldfinch 19. Red-wgd. Blackbird 20. Robin 21. Sparrow Hawk 22. Carolina Wren 23. G. C. Kinglet 24. N. Horned Lark 25. Red-headed Woodpecker

Mr. Sidney R. Esten (1931), in compiling the 133 Indiana Christmas Censuses from 28 counties for the years 1900 to 1929, found that 34,299 individuals and 74 species were recorded. The average number of individuals seen on each hike was 258 and of species, 16. The first ranking 25 species (numerical ranking) were as follows: Junco, Tree Sparrow, Crow, Tufted Titmouse, Song Sparrow, Chickadee (both species), Cardinal, Downy Woodpecker, Blue Jay, White-breasted Nuthatch, Mourning Dove, Bob-white, Goldfinch, Bronzed Grackle, Flicker, Prairie Horned Lark, Brown Creeper, Horned Lark, Bluebird, Red-headed Woodpecker, Hairy Woodpecker, Meadowlark, Robin, Carolina Wren, and Lapland Longspur. Indiana censuses indicated increases of Starlings, Crows, Cardinals, Mallards, and Herring Gulls, and decreases of Song Sparrows, Chickadees, Tufted Titmice, Blue Jays, and Downy Woodpeckers.

In Ohio, a number of factors make it difficult to conclude definitely as to any pronounced increases or decreases of the various bird species enumerated and this aspect would be too lengthy to discuss in the present paper. It is planned to continue to collect abundance data on each species from various sources, and to publish the same after a longer period of comparative studies.

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Hydrodynamics, by Sir Horace Lamb. Sixth edition, revised. XV + 738 pp. New York, The Macmillan Co., 1932.

Sedimentation.

The first edition of this important work was exhausted shortly after it appeared and now this new edition is available. The new edition is in truth a new edition. One part has not been rewritten because that part was written by Dr. W. D. Matthew, now deceased, with no one to take his place. The rest of the book has been so expanded as to be an entirely new book. Those who have a first edition will need the new edition. Those who are interested in sediments from almost any angle will need this new edition. It will be of use to the student of sediments, the paleontologist, the economic geologist, and the student of "hard rocks." One can get some idea of the increase of material in the new edition by a few comparisons. The old edition had 696 pages, 61 figures and 55 tables; the new edition has 960 pages, 121 figures, and 91 tables. The old edition referred to 697 authors, while the new edition refers to 819. It is a piece of work that Prof. Twenhofel is to be complimented upon. The publishers also deserve credit for the pleasing make-up of the new book. The use of calendered paper throughout and the clearness of the printing make it very pleasing.—WILLARD BERRY.

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